WASHINGTON
SCIENCE TRENDS

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* TACTICAL WEATHER SATELLITE

The Navy, in cooperation with Radio Corporation of America, has designed a 100 pound version of the successful Tiros weather observation satellite, for use in providing the fleet with tactical weather information. Breadboard models have been completed, with feasibility demonstrated on the ground. Components are available for an operational system, which could be launched by the first of the year.

✓ Push-Button Readout -- Navy officials, in secret testimony before the House Committee on Science and Astronautics, and in interviews, have expressed the belief that their Fleet Weather Satellite, code-named Renae, can give "push-button" readout of weather data without the delays of storage and retrieval inherent in the original Tiros, sponsored by the National Aeronautics and Space Administration. However, Renae uses many proven Tiros components, including the vidicon camera system, magnetic torque stabilization, power supply telemetry, command and communication systems.

✓ Tiros Components -- Tiros techniques proved of interest to the Navy by supplying new information on weather patterns in general, and (in certain circumstances) with information on the jet stream and roughness of the sea. Tiros, however, requires data storage on board the satellite and television transmission over a broad band link, requiring large ground installations.

✓ Fewer Pictures -- Renae satellite is designed to provide some 80 pictures per day, or just 5 per orbit, in comparison to the hundreds provided by Tiros. Instead of external storage devices, the picture is "literally stored in the television tube itself". Instead of using video or transmission type arrangements which requires a very broad band frequency, the picture is scanned slowly and transmitted on a narrow band, so that smaller transmitters could be used in the satellite and smaller receiver antennas, of about five feet diameter, aboard ship.

✓ Navy Equipment Does Double Duty -- Shipboard installations also use standard VHF receiving equipment and weather chart reproduction equipment, which are already in place. For the Army, or Marines, the same type of equipment could be packaged in a small truck carrying a portable antenna for supplying push-button readout of battlefield weather. The system is light enough for air, sea, submarine or land launching.

✓ Status -- The new administration in the Pentagon has virtually halted active development of this and other systems, including the Albatross, a sea observation satellite. However, many Navy officials express the belief that they already have sufficient authority to proceed. One Navy official points out that the necessity for answering memos has, more than anything else, slowed development work in the past few months. He points out:

"We have already processed enough paper to reach orbital altitude, without the necessity of procuring separate rocket boosters."

* GAS TURBINE PROGRAM

Army authorities say they plan no new gas turbine programs "unless there are some major breakthroughs or specific requirements are generated." Emphasis will be on the improvement of engines currently in inventory or under development. Research is said to indicate the feasibility of a change to gas turbines to power the Army's entire aircraft fleet within 10 years.

Areas of improvement in gas turbines will be:

✓ Increase of overhaul life from 150 to 1,000 hours.

✓ Improved specific fuel consumption.

✓ Better acceleration rates than the five seconds now required from flight idle to full power status.

✓ Lower costs than the $50,000 per copy now being paid for T-53 types.

The latest engine development initiated by the Army is the T-63 rated at 250 SHP, and currently in the "early stages of development" at Allison Division, General Motors. This engine, it is stated, is intended to replace reciprocating engines in the same horsepower category for future applications. The T-63 is described as "a strong contender for use in the light observation aircraft" presently being evaluated by competitive bid.

* WALKING MACHINE RESEARCH

A walking machine with 16 legs has been designed in a feasibility study for the Army, with the expectation that such a device could be used for battlefield transportation, lunar exploration, polar region supply missions and for crossing swamps or deserts impassible to wheeled or tracked vehicles. The "walker" would have a top speed of 40 to 50 MPH.

✓ Operation -- The machine would have four legs on each of four corners. While one of the legs on each corner was actually making a stride, the second would be lifting off the ground to return for another stride, a third would be returning and the fourth lowering for its step. The machine would operate by hydraulic mechanism, run by a standard engine turning over at a constant speed. Other features:

Length of the legs could be made to suit the purpose desired, and, according to design, there would be no weight restriction on payloads. Steering controls would use a feedback mechanism to show where the legs are. A turn would be made somewhat as with tracked vehicles -- legs on one side would be speeded up to turn in the direction of the other side. Reverse would be no problem, but the machine could not go sideways.

✓ Some problems -- Can the operator acquire sufficient skill so that he will instinctively know where his "hind legs" are?

-- Should the feet use skis or runners? What shape? What materials and dimensions? How are these to be attached?

-- Linkage is another problem. What shape, size, material, bearings? How are they gauged?

-- What suspension and cylinder system should be used?

-- Is an automatic control system best? What kind of hydraulic system is best? What optimum fuel and mileage?

(Studies reported by J. E. Shigley, Professor of Mechanical Engineering, University of Michigan, Ann Arbor, Michigan in a program for the Land Locomotion Laboratory, U. S. Army Ordnance, Detroit, Mich.)

TECHNICAL TRENDS

- The Air Force intends to solicit proposals from industry on or about April 19, 1961 for a large development-production contract leading to an automated North American Defense Combat Operations Center. Companies or teams of companies interested in the program should write: 425L Systems Program Office (SPO) L. G. Hanscom Field, Bedford, Mass. √√√ Information on "Research in Physics of a Fundamental Nature Within or For U. S. Army Ordnance" is available on request to Mr. P. White, Army Research Office, Box CM, Duke Station, Durham, N. C. √√√ The Department of Commerce has placed a number of technical products under export controls for all destinations except Canada. Included are certain electromagnetic wave absorbers, gyrostabilizers and similar equipment and a specified type of coated alloy steel. Details are contained in Export Bulletin No. 847 available from Bureau of Foreign Commerce, U. S. Department of Commerce, Washington 25, D. C.

- The Atomic Energy Commission has available for Free loan or purchase a new, 57 minute color film on "Industrial Applications of Radioisotopes." Loan copies are available at most AEC regional offices, or write Audio Visual Branch, Office of Public Information, U. S. Atomic Energy Commission, Washington 25, D. C. √√√ The U. S. Bureau of Reclamation is joining in sponsoring a national symposium on "the critical needs of basic engineering research in water resources development" at Colorado State University, Ft. Collins, Colorado, June 12-15. For program detail write Information Office, Bureau of Reclamation, Department of the Interior, Washington 25, D. C. regarding Announcement P.N. 90639-61. √√√ The Navy's Bureau of Ships has selected Booz-Allen Applied Research to conduct an operations research study for the Naval Advanced Communication System, and its associated Communications Control Ship. √√√ Details of a Postodoctoral Research Associateship program are available from National Bureau of Standards, Office of Technical Information, Washington 25, D. C.

- The Army is asking industry to submit contract proposals for updating a portion of its existing target simulators which are used in training crews to operate the Nike Ajax antiaircraft system. The Army Rocket and Guided Missile Agency wants the devices for use with the Nike Hercules system. √√√ The Federal Communications Commission, Washington 25, D. C. has issued Public Notice G-2763 detailing its inquiry into problems of regulating commercial space communication systems. √√√ New simplified standards for Acoustical Materials are available at 10 cents from Superintendent of Documents, Government Printing Office, Washington 25, D. C. Ask for SPR R262-60. √√√ The Office of Research and Development, Maritime Administration, Washington 25, D. C. would like to see letters indicating interest for prospective commercial operation of a 104-foot, 80-ton experimental oceangoing hydrofoil craft now nearing completion. The same office has issued invitations for qualified companies to submit proposals for design and possible construction of an integrated ship's bridge control system.

- Organizations with R&D capabilities in the study of aerosols exposed to natural and artificial sunlight, and monochromatic light are invited to submit complete details to U. S. Army Chemical Corps, Biological Laboratories, ATTN: Contracting Officer, Special Contracts Branch, Ft. Detrick, Md. by April 28, 1961. √√√ Bid material on surplus quantities of three platinum group metal powders is available from Projects Administration Division, Room 6030, General Services Administration, Washington 25, D. C. √√√ Organizations with specialized research and development capabilities in the following fields are being sought by the Chief, Bureau of Naval Weapons, Washington 25, D. C.: Continuous refractory oxide filaments for structural composite materials (write ATTN: Code RRMA-31); oil and weather resistant, non-staining, pressure-sensitive adhesives for preservation tapes (write ATTN: Code RRMA-51) and determination of extremely minute quantities of non-metallic impurities in Beryllium and refractory metals (write ATTN: Code RRMA-2). Complete supporting documentation is required by May 1.

RESEARCH CHECKLIST

□ LIQUID LEVEL MEASURING DEVICE: A prototype device, now being tested, may assist in the problem of remotely measuring the level of radioactive liquid wastes in underground storage tanks. An electrode "antenna" sheathed in fused quartz extends into the tank and feeds high-frequency radio current to the solution, which must be kept in the correct formation to prevent sludge and to warn of possible leakage. In the new device, proportionately more or less current is absorbed by the solution as the level rises or drops. The resulting information is carried by coaxial cable to a control panel, where gauges convert the expended power readings to liquid measurements.

(R&D by T. R. Cartmell, General Electric Company, Hanford Laboratories of the Atomic Energy Commission, Richland, Wash.)

□ DETERMINING TUNGSTEN PURITY: The Bureau of Mines has developed a solvent-extraction technique to determine copper concentrations in the few-parts-per-million range in tungsten metal powder. The studies are part of a program aimed at high-purity tungsten. The new method, which employs a spectrophotometer and normal analytical laboratory equipment, is limited to finely divided tungsten powder.

(Details available. 7 Pages. Single Copies Free. Write U. S. Bureau of Mines, Publications-Distribution Section, 4800 Forbes Avenue, Pittsburgh 13, Pa. for Report of Investigation No. 5720)

□ AIRCRAFT RADIATION COATING: The Air Force has developed a polyurethane coating to be sprayed on aircraft for protection against heat from nuclear blasts or from the firing of air-to-surface missiles. The pure white coating is also said to resist heat, moisture, synthetic lubricants and hydraulic fluids. The coating, which will also be sprayed on air-to-surface missiles, replaces enamels which were found to be affected by atmospheric heat and moisture, and which discolored on exposure -- picking up soil rapidly and causing a loss in protective qualities.

(R&D by Wright Air Development Division, U. S. Air Force, Dayton, Ohio)

□ POSSIBLE FUEL PUMP HAZARD: National Aeronautics and Space Administration is studying the possible electric spark ignition hazard of fuel pumps which employ carbon vanes so that the pumps can run dry for extended periods without undue wear. Carbon bearings, if exposed, might also produce a similar hazard. Tests showed that under certain circumstances, sparks from the carbon vanes could ignite a propane-air mixture surrounding the pump assembly.

(Details are available in NASA Technical Note D-589 from NASA, Attn: CODE BID, 1520 H Street, N. W., Washington 25, D. C.)

□ SEMIAUTOMATIC IRRIGATION EQUIPMENT: The Government has agreed to cooperate in the development and testing of a semiautomatic irrigation device said to show "encouraging" possibilities for distributing water from conveyance channels onto adjacent lands with less water waste and labor, and with fewer water distribution facilities than are now required. The machine's major functional parts include a siphon tube, power unit and floats. The power unit consists of an air-cooled gasoline engine linked to a standard passenger car wheel at the outlet end of the siphon -- for moving the device along a ditchbank and controlling rate of movement. Floats in the conveyance channel keep the siphon at the desired depth and in proper alignment.

(R&D by the University of Wyoming, Eden Reclamation Project, Wyoming and the Bureau of Reclamation, U. S. Department of the Interior, Washington 25, D. C.)

□ SATELLITE CONTROL MOTOR: The Air Force has awarded a $58,800 contract for further study of a pulsed plasma motor which may have application as a satellite control device. The motor is roughly the size of a human thumb, and resembles a miniature crater. It operates with a solid propellant in the form of a metal wire which is fed to a center electrode. High voltages from a capacitor ionize the wire and plasma, emitted from the center electrode, provides the motor's thrust. It is estimated that 100 such motors, taking up one cubic foot of space, could control a 1,000 pound satellite.

(Contract awarded by Air Force Office of Scientific Research for studies directed by W. H. Bostick, Stevens Institute of Technology, Hoboken, N. J.)

□ NEGATIVE ION STUDIES: The Navy is sponsoring studies of the photodetachment of electrons from negative atomic and molecular ions. The studies have significance in both geophysics and astrophysics -- the study of ionospheric phenomena and thermodynamic systems involving very hot gases.

(For details, write National Bureau of Standards, Office of Technical Information, Washington 25, D. C. regarding "Negative Ion Studies")

□ PREPARING THORIUM METAL: The U. S. Bureau of Mines has devised a new method of preparing thorium metal of high purity for use in nuclear applications, and as an alloy component with magnesium for high temperature environments. The Bureau reports that conditions have been established for preparing cold-ductile thorium metal by an inert-atmosphere reduction technique, using either high purity commercial magnesium or high-purity commercial sodium as reducing agents. The metal can be readily fabricated to thin sheet, which, after annealing, remains soft and ductile.

(Details available. 12 Pages. Single Copies Free. Write U. S. Bureau of Mines, Publications-Distribution Section, 4800 Forbes Avenue, Pittsburgh 13, Pa. for Report of Investigations No. 5702)

□ BIOCHEMICAL FUEL CELL: Electrical energy is being produced directly from decomposition of organic matter created through photosynthesis and biological processes in the sea. Such energy is normally dissipated as heat under natural conditions. Some details:

✓ Prototype Unit, referred to as a biochemical fuel cell, is composed of two sections containing inert electrodes -- an anode section and a cathode section -- separated by an ion-diffusion bridge. A mixture of sea water containing organic matter as fuel, and bacterial cells (or enzymes) as a catalyst is placed in the anode section. The cathode section contains sea water and oxygen. Essentially, the energy released comes from bacteria "burning" the organic matter. However, the cell design is such that the energy is released as electricity, instead of heat.

✓ Fuel and Oxygen Source can be obtained by placing live algae in the cathode section. Such a cell, containing inorganic salts, bacteria cells and algae could conceivably produce electricity from solar energy alone. It is also suggested that such a cell might be adapted for use in outer space. An additional advantage is the fact that a great variety of otherwise practically useless organic materials could be used as fuel in place of solar energy -- and converted directly to electricity.

✓ Prospects of such a system are almost unlimited according to its developers. The efficiency of the biochemical fuel cell in the production of electrical energy from fuel is estimated to be equal to or higher than that of the most advanced types of conventional power plants. It is believed that a much higher efficiency biochemical fuel cell can be developed which may result in a "revolutionary source of power" for specialized and industrial use.

(Research and Development directed by Frederick D. Sisler, Biochemist, U. S. Geological Survey, Department of the Interior, Washington 25, D. C.)

P U B L I C A T I O N C H E C K L I S T

- RELIABILITY OF TURBOJET ENGINES, a comprehensive report on the problem of obtaining high operational reliability for turbojet engines. Covers such subjects as failure statistics, foreign-object damage, blades, buckets, disks, bearings, engine fuel controls and similar aspects. Also discusses areas where further information is required. 211 Pages. (Government contractors may write NASA, ATTN: CODE BID, 1520 H Street, N. W., Washington 25, D. C. for copies of Technical Report R-54. Available to others at $1.75 from Superintendent of Documents, Government Printing Office, Washington 25, D.C.)

- ZINC COATING FOR COLUMBIUM, a summary of studies in the past two years of zinc coatings for columbium to provide oxidation resistance at elevated temperatures. Studies show that such coatings also prevent contamination hardening of columbium, and posses remarkable self-healing properties. 19 Pages. Single copies free to Government agencies, contractors, subcontractors and their suppliers. (Write Defense Metals Information Center, Battelle Memorial Institute, Columbus 1, Ohio regarding DMIC Memorandum No. 88)

- ION PROPULSION, an August 1960 Analysis by Rocketdyne Division, North American Aviation, Inc. now available. Surveys major problems associated with an ion rocket system including such components as electrical power generation systems, thermal power conversion and accelerating electrode configurations. 70 Pages. (ARL Technical Report 60-279 available through military channels or at $2 as PB 171 305 from OTS, U. S. Department of Commerce, Washington 25, D. C.)

- QUESTION AND ANSWER SUMMARIES, now available on the following topics: "Fuel Cells," "Mechanical High Energy Shock Treatment of Materials," "Proton Microscope" and "Storage of Liquified Carbon Dioxide." Available free on request by title. (Write Information Unit, European Productivity Agency, 3 Rue Andre Pascal, Paris XVI, France)

- EXPLOSIVES, EXPLOSIONS AND FLAMES, a new summary of research and technology in these fields by the U. S. Bureau of Mines during Fiscal 1959. 35 Pages. 30 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for U.S.B.M. Inf. Circ. No. 8000)

- IMPROVING THE AEC REGULATORY PROCESS, a collection of study materials compiled for use by the Congress in considering the reorganization of the Atomic Energy Commission and its many procedures. 600 Pages. Single Copies Free. (Write Joint Committee on Atomic Energy F-88, The Capitol, Washington 25, D. C.)

- TITANIUM IMPURITIES, a technical report on the effects of impurities on the mechanical properties of electrolytic titanium. 12 Pages. Single Copies Free. (Write Publication-Distribution Section, U. S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa. for Report of Investigation No. 5701)

- RADIOLOCATION TECHNIQUES, one of a series of seven volumes prepared by the British War Office. The latest volume covers the principles of direction finding and the various systems now in use, the characteristics of radar displays and similar topics. 272 Pages. $2.70. (Write British Information Services, 45 Rockefeller Plaza, New York 20, N. Y. for "Radiolocation Techniques")

- BRITISH FUEL RESEARCH, an account of studies at Britain's Fuel Research Station from 1917 to 1958. Summarizes information available with references to papers and reports containing more detailed information. 132 Pages. $2.70. (Write British Information Services, 45 Rockefeller Plaza, New York 20, N. Y. for "Fuel Research, 1917-58")